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ABSTRACT

This paper presents a framework for conceptualizing and analyzing the problems of educating rural youth for mathematical knowledge, and for improving both rural school mathematics and the conduct of research in rural environments. The background for this framework includes discussion of widespread rural poverty, the lack of a commonly accepted definition of "rural," and the importance of social and cultural context. In the foreground is a pervasive "culture of failure" in rural communities with regard to mathematics learning. It is proposed that the central questions of a research agenda should reflect the essential, unique nature of rural mathematical education, and especially explore it as a culture of failure. The framework includes general questions for framing research in schools, primary research dimensions for studying rural school change, guiding principles and research questions related to teacher emotional dimensions of reform, guiding visions on developing teachers as leaders in the school system, and guiding visions on university impacts from school reform efforts. A research agenda is elaborated that seeks to understand the culture of failure as the first step in initiating a cultural revolution in rural mathematical education across schools, homes, and communities. Recommendations are offered for further development of the research agenda and related educational reform initiatives. (SV)

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Working Paper Series

"Up the Back Holler, Down the Dusty Road, Cross the Windy Prairie": Issues, Perspectives, and Strategies for Research in the Crisis of Improving Mathematical Education of Rural Youth

Working Paper No. 10

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March 2003

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ACCLAIM's mission is the cultivation of *indigenous leadership capacity* for the improvement of school mathematics in rural places. The project aims to (1) understand the rural context as it pertains to learning and teaching mathematics, (2) articulate in scholarly works, including empirical research, the meaning and utility of that learning and teaching among, for, and by rural people, and (3) improve the professional development of mathematics teachers and leaders in and for rural communities.

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"Up the Back Holler, Down the Dusty Road, Cross the Windy Prairie": Issues, Perspectives, and Strategies for Research in the Crisis of Improving Mathematical Education of Rural Youth

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November 3-6, 2002

"Up the Back Holler, Down the Dusty Road, Cross the Windy Prairie": Issues, Perspectives, and Strategies for Research in the Crisis of Improving Mathematical Education of Rural Youth[1]

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Overview

My goal herein is to contribute to the development of a significant agenda for research related to the mathematical education of rural youth. In particular, I seek to stimulate the participants of this first Research Symposium of the ACCLAIM Center. As a national leadership project focused on rural issues and mathematics education, the Center holds the promise of helping to develop a nationwide response to the problems and challenges of improvements for rural youth.

I will first discuss matters of background and foreground, and how these might interact as we grapple with perceiving, defining and understanding the problems, which I submit is the basic research problem. Then, I will posit a framework for conceptualizing and analyzing the problems of educating rural youth for mathematical knowledge, and for improving both rural school mathematics and the conduct of research in rural environments. Thereafter, I will offer specific ideas and directions for elaborating and refining the research agenda for the ACCLAIM center, as well as how such scholarship can contribute to other goals and activities of the center.

I wish to emphasize that the perspectives and assertions I am presenting are based upon my personal views. My viewpoints reflect my own values, beliefs, experiences, reflections and interpretations, and do not necessarily represent the kind of broadly based

analysis needed at this point in time for our field. One implicit goal of this paper is to stimulate and invite such analytical discussion.

Background

Without question, our rural youth face serious, complex problems. Most of these problems, already long-festering, now constitute a crisis made worse by the absence of national and state policies for dealing with rural poverty. Too many of America's rural youth are living and developing in widespread poverty (Herzog & Pittman, 1995), bound up in a knot of unmet needs. Those needs include challenges to mental and physical health, a healthy educational system, and disintegrating economies with few or poor jobs causing out-migration, all set against the unique cultural values and traditions of rural communities.

I assert this without question as one who lives and works in rural Georgia, knowing firsthand what I experience and perceive around me. I also bring my experiences from my own rural origin, having been raised during the 1940s and '50s on a prairie farm in western Minnesota. One of the challenges of today's rural reality, however, is the paucity of data to document in deep and penetrating ways what we who are gathered here may believe. We lack the kind of data that constitutes the evidence policy makers need to forge solutions to the problems. It is possible to find broad, general indicators of rural poverty that, if heeded, signal an alarming array of issues and needs. Yet, seemingly little is known of the extent or scope of the problems, the depth of debilitating impact, or the particular complex interactions of these unmet needs as they play out for rural youth and their families, whether caught in poverty or not. Particular

connections of these problems to the learning and teaching of school mathematics need to be investigated.

Perhaps such background data is not available, or is confounded in existing data, because there is no commonly accepted definition of what constitutes "rural America." During the last century, what predominately characterized rural life, namely family-based agriculture and its allied industries, businesses, and communities, was broadly replaced by large agribusiness operations wherein mechanization forced major shifts in employment patterns. Population growth, primarily in urban areas, coupled with increased transportation capacities via improved roads and faster cars, has led to migration of city dwellers into ever more distant rural "bedroom" communities. One characteristic of rural life, namely relative isolation, has dramatically changed, accelerated by the ubiquitous telephone and television.

In what were distinctly rural areas only a few decades ago, populations today include commuters who live in the country but work and shop in metropolitan areas. When rural communities lack employment opportunities, many with rural roots have joined the newcomers to commute to work in the cities and their suburbs. Even more dramatic has been the outflow of rural youth moving to live in the metropolitan areas in search of jobs or more stimulating environments. This mix of who now resides in rural areas may often mask the true nature of the problems and needs, with economically and educationally advantaged families surrounded by families suffering in relative poverty. Further, with jobs, shopping and entertainment based in the city, the local tax base suffers, leading to inadequately funded schools and social services. In rural locales the

economic gap can be wide, representing a social, cultural and educational dichotomy that presents unique challenges and transformations to communities and schools.

For our purposes, I want to consider three major domains as background for a focus on research related to the teaching and learning of school mathematics of rural youth. These are the *school*, the *home*, and the *community*. I take as a starting premise:

> If we are to understand deeply and sensitively the problems of educating rural youth in mathematics, then we must also understand the background contexts in which these youth are born, live and grow up, and in which their educators and parents fulfill their roles, both in historical and contemporary terms.

We must seek to understand the strengths, as well as the weaknesses, of these contexts in order to address or consider prospects for improving the mathematical education of these rural youth. We need to understand *contextual factors* that impinge on the teaching and learning of school mathematics in rural classrooms. I also assume a related premise:

> A successful reform of the mathematical education of rural youth must necessarily involve the concerned stakeholders in each of these domains – teachers and administrators, parents and extended families, and school boards and other citizens.

Among the implications of these premises is the recognition that efforts to understand or change matters for rural youth must account for many social or cultural factors typically not addressed in reform initiatives. Later in the paper, I will try to

identify factors, issues, and prospects related to each of these premises that might help to shape a research agenda for the Center.

Foreground

In the foreground of my picture are matters of concern to educating rural youth for mathematical knowledge. I'll address each of the school, home, and community domains.

A *culture of failure* in school mathematics exists and pervades rural communities.[3] It appears to be socially acceptable to fail to understand or achieve in mathematics. Too often, parents' hopes that their children will break the vicious cycle of poverty through educational achievement, especially in mathematics, go unrealized. Accumulated deficits of understanding and proficiency in school mathematics result in an increasing knowledge gap that the learner usually cannot overcome. Doors of opportunity to study and succeed in advanced mathematics are slammed shut, leaving little chance of successful access to higher education.

This "culture of failure" exists in all three domains: school, home, and community. Within rural schools, it functions to lower local standards and expectations, as teachers and administrators come to expect less or even give up on many students ever learning and succeeding in high quality school mathematics. Let me provide some indicators from Georgia.

Far too few students in rural Georgia schools are achieving acceptable levels of learning school mathematics. Not surprisingly, a review of the 2000-01 Georgia Public Education Report Card (http://techservices.doe.k12.ga.us/reportcard/) data for individual school systems shows dramatic differences among our most poor rural and most advantaged suburban schools. Within Georgia school systems, African-American students, as a group, perform most poorly. Black males dominate the poorest achievers. Mathematics continues to be a primary curricular area where a majority of African-American students

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fail to construct the essential knowledge required if they are to function as informed citizens, to offer parental support for their own children's mathematics learning, or to pursue post-secondary education or technical careers (Tate, 1997; Steele, 1997; Ladson-Billings, 1998).

Several indicators offer evidence of lowered local standards. Data for six school systems, three advantaged urban or suburban and three rural, are shown below in Table 1.

Table 1. Selected Indicators for Six Georgia School Systems

	Fayette	Gwinnett	Oconee		Greene	Hancock	Mitchell
% Black	14.1	16.4	7.2		75.8	98.4	73.3
%Diplomas Black	10.8	11.4	4.3		66.7	100	82.6
%GHSGT Math GA 91 (rank:174) *	97 (3)	96 (5)	96 (5)		79 (159)	63 (174)	84 (138)
SAT-MAT Avg (rank:174)	531 (1)	522 (4)	525 (2)		445 (156)	378 (173)	392 (168)
%AP 3 or higher ** (rank:122)	67.5 (10)	65.7 (15)	77.3 (3)		7.1 (119)	0 (122)	0 (122)
% Grads in L.S. in GA colleges ***	8.2	13.6	10.2		20.0	42.9	48.1
Per capita income	$31,922	$31,893	$26,261		$20,292	$16,787	$21,392
%Unemployed	1.9	2.3	1.4		6.1	9.5	6.1

* GHSGT: GA H.S. Graduation Test Math—91% pass Statewide
** Scoring 3 or higher on Advanced Placement examinations
*** L.S.: Learning Support (remedial) services

In the child's home life, this "culture of failure" can span generations; parents, grandparents, and extended family members internalize it in their own schooling and believe without reservation that the next generation cannot succeed at, or enjoy,

mathematical learning. Such lowered family expectations deeply undermine the innate mathematical ability or potential of particular students.

Paradoxically, the community as a whole may manifest attitudes that outwardly recognize the importance of learning mathematics while implicitly accepting the overall failure of local youth to strive for excellence in the subject .. Without a culture of expectations for high quality goals for the local school mathematics program, the community can inherently defeat even those teachers and students who strive for something better. Across all three domains, this "culture of failure" becomes a modulating force with a dire impact on local youth.

Within this culture, parents and other citizens pay taxes to support their schools. Often, when they witness or see reports of failures or poor results, they become frustrated and complain or criticize the school system. Often they do not understand the challenges facing educators or the significant changes in contemporary expectations in curricula and outcomes, especially as manifested in the various NCTM Standards (NCTM, 2000). Typically, concerned citizens do not have a constructive way to help or change these circumstances.

I would hope that the fundamental purpose for NSF investing in ACCLAIM is to initiate and support in Appalachia a "cultural revolution in rural mathematics." I see the Research Initiative functioning in three ways. To the extent possible, this "cultural revolution" should be research-based. Therefore, the initial research should be framed to investigate the current state of the participating rural sites, especially focusing on the nature and scope of this "culture of failure." I'm confident that the complexity of such studies would warrant years of research, yet the ACCLAIM improvement initiatives can

not be delayed. Thus, the second functional component of the research agenda, namely the study of the processes and impacts of center reforms and improvements, will need to be put into operation. The third research component would function as a meta effort to document and assess the strategic approaches of the center, in order to contribute to our knowledge of how such collaborative, systemic transformations function.

A Framework for Conceptual Analysis

Research related to rural mathematics education can serve a multiplicity of purposes or goals. In general, such research should deepen our understanding of the conditions, events, impacts and consequences of mathematical education in rural contexts. A further goal might be to understand what factors or events are most important, or which are the primary barriers to a sound mathematical education. Overall, the central research questions would reflect the essential, unique nature of rural mathematical education, and especially explore it as a "culture of failure."

There are surely many different ways to formulate research questions for shaping an ACCLAIM research agenda. One general structure is suggested below in Table 2.

Table 2. Questions for Framing Research in Schools

- **What might we study, and how might we study it?**

What research information would be needed, for whom, and for what purposes?
What questions might guide the search for this information?
What specific contexts or venues of project activity would be studied?
What observations or indicators would be obtained to serve as data?
What is the role of student data in these research efforts?

- **How might we understand what we find?**

What analytical approaches would be taken to make sense of the data?
What criteria or interpretative schemes might be applied to the complex phenomena?
What confirmation or clarification tactics might be used to obtain greater consensual agreement in the results?
How might the researcher(s) balance complexity—what is sound vs. noise?

- **How can we tell such a complex, possibly long-term story?**

What reporting methods can be used in research on the status or improvement of rural mathematics?
What is the role of case studies (or other qualitative approaches) versus experimental studies in an overall research effort?
How can we go beyond words and numbers to use multimedia exhibits to capture more of the deep structural qualities of the rich detail and complexity?

- **What is the role of theory building in this research?**

Why formulate theory, and for whom?
What might be generalizable or reproducible, and how can we be sure?
How might "outside" theories help to ground or influence theories of rural mathematics?
How might theory guide future improvement and research efforts?

Whichever template or structure of overall questions might be adopted within the ACCLAIM Research Initiative, such research will need to consider the following primary dimensions (see Table 3). Each dimension will surely embody many complex variables, and the interactions of these dimensions and variables represent additional complexity. It

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will require considerable insight and care to identify the particular variables or factors that will matter in studies of rural mathematical education. Further, how these variables are treated in designing research investigations (e.g., dependent, independent, concomitant, "noise") will greatly influence the possible findings. To further characterize each dimension, following this list I offer a brief elaboration and commentary for each dimension.

Table 3. Primary Research Dimensions to Study Rural School Change

- **beliefs—epistemological, philosophical and psychological premises and views**
- **intentions—educational needs, visions, goals and purposes**
- **contexts—socio-cultural background environments (family, community, school, classroom, peer group)**
- **institutions—sites for educating and investigating key phenomena**
- **controls—authority and power for governance decisions, both professional and political**
- **participants—stakeholders, who are and should be involved, their roles and functions**
- **communication—venues, vehicles, and strategies for interacting, sharing, fostering a socio-intellectual dynamic among and for all participants**
- **theory—organized, systematic abstractions as inputs and outputs**
- **meta-disciplinary—systemic perspectives and strategies for assessing, evaluating, and adjusting the directions and endeavors within the efforts**

In two prior, unpublished conference papers (Hatfield, 1998, Hatfield, 1999), I have identified an elaborate model that focuses on teacher professional development as a key strategy for local systemic reform.. The model (see Appendix A) includes clusters of components derived from my analysis of what we experienced in the conduct of Project LITMUS, a system-wide, NSF-supported Teacher Enhancement effort, focused on technology infusion in the teaching of K-12 mathematics and conducted during 1990-98 with two rural Georgia school systems.

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Consider teachers as one, albeit critical, dimension for improving rural mathematical education within the ACCLAIM initiatives. First we frame some visions for the reform work. These then become guiding premises for framing the associated research. The items below (see Table 4) could serve as visions for possible emotional elements related to building interpersonal relationships among teacher participants.

Table 4. Guiding Visions on Teacher Emotional Elements

- **Be especially attentive to teacher beliefs and values.**
- **Be concerned with (and sensitive to) the teacher's self-concept.**
- **Work to build professional relationships with, and among, project participants that are truly cooperative and collegial..**
- **Be sensitive to the teacher's personal goals for self-improvement.**
- **Recognize individual differences in patterns of professional growth and change.**
- **Be present in the teacher's 'world'—school and classroom—through school-year follow-up.**
- **Be aware of the isolation that teachers can feel, and help them to overcome it.**
- **Honor the excellence of teachers resulting from their professional growth in the project, and celebrate their achievements of new levels of excellence via significant outreach opportunities, awards, and publicity.**

Such perspectives may suggest significant implications for planning and conducting a teacher enhancement effort, and it is likely that many project leaders do address such factors in an effective reform effort. Beyond that, these perspectives may suggest important research dimensions, but to operationalize any such investigation will demand thinking with guiding questions like those posed above – what and how to study the potential effects of such affective factors on the project, and the potential impacts of

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the teacher's activities and experiences in the project upon his or her emotions as a teacher. Some examples of specific questions for research follow in Table 5.

Table 5. Research Questions Related to Teacher Emotional Dimensions of Reform

1. What attitudes about using technology in teaching mathematics do teacher participants have before the project begins, and at the completion of the project? **2. What beliefs and values related to teaching and learning mathematics seem to determine the attitudes of the teacher participants about the NCTM Standards, both before and after the project activities?** **3. What is the nature of the teacher's self concept related to being a mathematics teacher, and how does it change over the duration of the project efforts?** **4. How does the teacher view her/his relationships with other project participants, and how does this view change over the duration of the project?**

5. In the case of little change in teaching practices, what emotive factors in the teacher may help to explain the lack of change?

As another example, consider the following ideas as visions for possible school- and system-based cultural elements, relationships with and among its stakeholders, building teacher participants as leaders, and thereby influencing the essential infrastructure to ensure lasting change. From such perspectives we could identify possible constructs to be used in planning research within the reform project (see Table 6).

Table 6. Guiding Visions on Developing Teachers as Leaders in a School System

• **Work to understand the real school system, especially as it functions as a culture.** • **Develop strong working relationships with local school officials, especially to establish honest links with key informants, with key decision makers, and with those who wield power and influence upon others.** • **Seek to formulate new ways for teachers to grow professionally within the system; project goals should promote and emphasize development of teacher leadership.** • **Develop strategic approaches that help teachers to become functional leaders.** • **Be sensitive to variation and individual difference in teachers as leaders.** • **Acknowledge those teachers who become real, contributing leaders.** • **Try to determine what factors may affect those teachers who do not become leaders.**

- **Work with teachers and administrators to develop and establish lasting changes to the infrastructure that will continue to support mathematics teachers in their efforts to lead in the improvement of the local mathematical education program.**

Again, such perspectives or visions, incorporating several of the components of the model, can be used to shape the planning and conduct of the project itself. They also can serve as starting points for conceptualizing the project's research dimensions. In each case, how we identify particular attributes, how we frame our descriptions, what we choose to assess and document, and what values observers bring to the interpretations are critical to what is learned. While there may be more objective indicators within each that could be identified and included, important qualities related to each construct will involve highly subjective phenomena, from the viewpoints of both the participants and the observer(s). This suggests a team approach to assembling the observations or indicators would be useful, for by sharing and discussing what is observed, particular biases and perspectives may become clearer.

A third example could involve the ways that the reform project directly influences not only the conduct of mathematical education in the local school system, but also the mathematics teacher education programs of the collaborating university. Consider the following ideas as visions for possible University-based components within a co-reform perspective that sees the school improvements leading to important changes in participating university faculty, in university degree programs, in other outreach activities, or in the essential infrastructure of the higher education mission (see Table 7). Here again, such visions could be used as stimuli for research.

Table 7. Guiding Visions on University Impacts from School Reform Efforts

- **Build strong commitments from all participating campus faculty.**
- **Establish the institutional commitments and resources needed to support a sustained partnership with participating school systems.**
- **Consider how the involvement and experiences of the university faculty might significantly change them as functioning mathematics teacher educators.**
- **Look for ways the project activities can affect the regular mathematics teacher preparation programs.**
- **Consider how the design of the project might change the ways that the university might conduct regular in-service, continuing education of teachers and administrators. Study the impacts and consequences of the Teacher Enhancement project on the university.**
- **With a clear emphasis upon research within the reform project, there may develop continuing collaborations afterwards on additional research and scholarship.**

As before, such perspectives or visions can be used to shape the goals, intentions, and designs of the project, and can also serve as focal points for conducting research. This dimension can be both an important part of the project and a significant domain of inquiry. In many ways, this dimension may have the most important long-term consequences for the university and for the infrastructure of mathematics teacher education nationwide.

Elaborating the ACCLAIM Research Agenda

Given this backdrop of perspectives for conceptualizing and investigating improvement efforts for rural school mathematics, I will now suggest some specific ideas for elaborating the ACCLAIM research agenda (http://kant.citl.ohiou.edu/ACCLAIM/).

The ACCLAIM project seeks to build mathematics capacity and expertise while improving the quality of mathematics teacher education and school mathematics teaching

in Appalachia. Research is central to these goals. Stimulating research and carrying it out are essential in order to build capacity. So to is increasing the number of mathematics educators at all levels who know how to conduct and apply research addressing rural mathematics problems – and who want to do so. These educators should include not only doctoral-level scholars, but also school-level administrators and teachers. Helping teachers and administrators to become participating colleagues in school-based research efforts should, for many reasons, be an important perspective in professional development activities, including teacher preparation.

The basic issues of improving and understanding mathematics education in rural contexts mirror those in many other U.S. communities. Improvements in mathematics teaching and learning, grounded in a deep understanding of mathematics, psychology, philosophy, sociology, and culture, are needed essentially everywhere. Yet, I believe that there are unique aspects in rural schools, homes, and communities that make mathematical education problematic – aspects that the ACCLAIM research agenda should emphasize. We need to understand why children do or don't learn mathematics in schools everywhere, but we also should discover the particular, and perhaps unique, contextual factors that apply to teaching mathematics to rural children in rural schools.

I have already posited that there is a "culture of failure" in rural contexts. Our research agenda should include understanding and delineating this culture: Does it exist? What is its nature? Can it be documented? How does it exist in different rural communities? Does it exist in non-rural settings? If so, how do the inherent qualities differ? How might we study this culture? For me, striving to study and understand this culture is one of the essential groundings or foundations for improving rural

mathematical education. Strategically, project scholars need to investigate this culture as one view of the landscape. How to do so? Can we adopt perspectives and methodologies of the cultural or social anthropologist?

If we can begin to understand the nature of this "culture of failure," then we might be better able to envision interventions that could dismantle it, interventions to shift the values, beliefs, and attitudes of rural citizens related to mathematics learning and teaching. For me, this implies that the fundamental strategic approach within all ACCLAIM initiatives needs to address this specific matter.

For instance, focusing on the scholarship of rural mathematics education, the Capacity Building Initiative should bring faculty and graduate students together to draw attention to and collaboratively investigate this "culture of failure." Within the Professional Development Initiative, I urge a three-pronged approach. To disrupt this cycle of failure, I propose ACCLAIM initiate a "cultural revolution in rural mathematical education" in Appalachia. The culture of underachievement and failure to learn mathematics must be replaced by a new kind of rural mathematics culture. This new culture would help rural citizens of all ages construct and appreciate mathematical knowledge in their lives; it would also help mathematical sciences academics understand and respect the unique needs and values of rural Appalachian citizens.

Achieving this cultural change would require a new type of partnership: a *triadic support system*, or "three-legged stool," involving participants from the (1) schools and higher education partners, (2) homes, and (3) communities – educators, parents, citizens. I have proposed such a partnership involving six rural Georgia counties, entitled the

Georgia Academy for Mathematical Excellence in Rural Schools (GAMERS)..[4] Through such a partnership, we will seek to build new communities by stimulating and supporting collaboration among sub-groups, and by linking from within and across these counties to new external partners: a stool is stronger with bridging links (rungs) between it legs.

Of course, the substance of our work will be to enhance the mathematical experiences and knowledge in all three domains: school, home, and community. For the school leg, our proposed interventions would include intensive graduate degree programs for teachers at Early Childhood, Middle School, and Secondary levels. Through my Project Keystone, our faculty has designed 12 new programs for teachers in grades K-5 and 6-8 encompassing mathematics, statistics, and mathematics education and aimed at deeply preparing Leader Teachers as mathematics teaching specialists. Additionally, we would offer a series of four 20-hour staff development workshops to assist Partner Teachers. All teachers will have a critical support – individual classroom mentoring and follow-up. School administrators and counselors will also be involved in professional development to deepen their understandings and sensitivities to the goals and strategies of the support system for improved mathematics.

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For the home "leg" of the stool, we would involve parents in activities aimed at helping them to understand and support their child's mathematical development. We plan to provide "Home Math" activities, parent workshops, a "Home Math Help Line," and a web-based "Home Math Chat Room." In the community domain, we would engage citizens in activities that draw attention to the value of learning and using mathematics, and that support and enrich students and teachers. We have plans for a Rural Mathematics Mentoring Network, After School Math Fun, local Summer Math Camps, and a summer Math Academy at UGA for the most motivated, highly promising mathematics students.

As stated in our proposal, the activities of the Georgia Academy will function as a systemic reform effort, one that is both *system-wide* and *systematic*. Taking a cultural view implies that the system encompasses all partners at both the personal and institutional level. To achieve a cultural revolution in rural mathematical education, at some point all stakeholders in the triad must become committed to, actively participate in, and be positively affected by the new values and norms – children, teachers, parents, citizens, local agency workers, church and organization members, government officials, higher educators, and professional developers, academics, and researchers.

Additionally, the strategies and activities constituting the reform effort will be conceptualized and organized to function systematically. Realistically, not all stakeholders will initially choose to be involved; overcoming tradition and inertia will take time, but our goals must be to cultivate the communities and grow the participation both in depth and extent. The current culture is a balanced, homeostatic system; it remains unchanged because most participants maintain the past and current values and

expectations. Through the interventions of the Academy, however, we will seek to perturb the balance in positive ways. Achieving reform can result from creating a critical mass of those with new values, beliefs, and behaviors such that the perturbations they cause unbalance the system and then shift it toward a new center of balance. The reluctant and hesitant eventually become the minority, and from witnessing new approaches, new expectations, and new results, become compelled to be involved in the change process. None of this process can be forced. It must unfold naturally and positively, and it will take time. Like good learning, a cultural transformation may best occur when the participants are largely unaware that they have learned or changed in their values, beliefs, attitudes, aspirations, convictions, and expectations. New knowledge of mathematics and its effective teaching and learning is the keystone to such change.

One very important quality about this vision is that we adopt a broader conception of systemic reform. Convention would limit the focus to the cognitive dimension, emphasizing mathematics almost exclusively in content, pedagogy, and curriculum. Our broader conception acknowledges those emphases are necessary, but not sufficient. So much of what transpires in a culture of failure or under-achievement is mirrored in the emotional dimension of mathematical experiences; we will, therefore, give equal attention to strengthening or improving the values, beliefs, attitudes, self-concepts – the emotional structure – of the participants. In our assessment and evaluation data, we will examine affect as intently as intellect.

Finally, let's consider the ACCLAIM Teacher Education Initiative. This effort seeks to strengthen and amplify the preparation of middle school and high school mathematics teachers. The Research Initiative should connect with these efforts in at

least two ways. First, findings from RI-sponsored investigations of landscape, comparisons, and best practices can influence the design, content and conduct of new teacher preparation programs. In that vein, undergraduates in the programs could be involved in schools where RI-sponsored research is underway, thereby ensuring a deeper readiness for beginning teachers to undertake action research and to participate in future research projects. Secondly, one focus of attention in the Research Initiative must surely be on studies of teacher preparation itself.. In the current RI chart identifying three types and four levels or areas, research in teacher preparation appears to be missing.

The challenge of stimulating and supporting needed research to improve rural mathematics education is surely enormous and complex. The current framework for the ACCLAIM Research Initiative appears to be a good start. I strongly believe that a substantial conceptual analysis that leads to an elaborated framework is needed. I would offer the following views and advice on how that might proceed.

1. Because of the need to link to other ACCLAIM initiatives, I would recommend that the RI organize and conduct a series of research planning work sessions that include key personnel drawn from center participants identified in all initiatives. I would include faculty, doctoral students (especially those who are already faculty at teacher preparation institutions), school administrators and teachers, and citizen leaders from all key sites collaborating in the center. What do these key persons say is needed from research in support of the improvement of mathematics learning and teaching at all levels, Pre-K through graduate? The primary purpose would be to elaborate and articulate the frameworks and strategies, but focus on identifying needs, barriers, sites, anticipated results, and so on.

2. The basic research strategy would be cyclical and multi-layered. Cycles would be conceived as repeating – but expanding and penetrating – efforts that generate successively clearer findings or results. Multi-layered approaches would vary in detail, specificity, and proximity related to project activities and outcomes. Cumulatively, the research would provide a rich, thick, detailed description of progress in transforming the mathematical culture in schools, homes, and communities of Appalachia. These cycles or layers could be a third dimension orthogonal to the current two-dimensional framework table.
3. In all initiatives, I urge that the vision of mathematical education be framed to be highly progressive and forward looking. Don't work with a view to "bring rural mathematics education up to current standards," but rather work to transform it to a mathematical education for 2010 and beyond. Have visions and make designs that establish reforms on powerful, future-oriented paradigms.
4. Help all stakeholders share in formulating these visions aimed at preparing their students for their future needs and uses of mathematics. To do this, one ACCLAIM strategy must include helping local leaders share such a vision. For example, town meetings could be held to show the kind of mathematical content to be offered, the kind of powerful technology tools to be used, or the kind of teaching methods their teachers can learn. These will help educators, parents, and school board members understand the transformations to be sought, a step that could be critical to visionary transformations. Again, all of these become research sites, especially for documenting and assessing the process and scope of the improvement effort.

5. Seek ways to offer alternative opportunities for rural youth. One of our GAMERS partners is the newly created Technical Career Academy of Northeast Georgia. This alternative high school is developing new programs of study for students who aren't college bound. Vocational in orientation, its courses seek to prepare students for careers in electronics, robotics, medical technologies, and other high-tech fields. The mathematics and science courses, although more applied, are substantial, focused on the kinds of technical problems to be found in these careers. The school is building courses; its first students started this Fall. Graduates will typically go on to an area technical college, which now has the same core as our university system, so they can transfer quite easily into a four-year institution if they wish.. Such alternatives for Appalachian youth would extend the ACCLAIM initiatives beyond the normal or current school environs, but I deeply believe that alternatives are needed if we hope to unravel the "knot of unmet needs" I described earlier in this paper. Such creative alternatives could greatly contribute to building a more future-oriented mathematics culture, and in the meantime become potential powerful research sites.
6. The potential impacts of infusing powerful technology applications into the learning and teaching of mathematics at all levels need to be studied. I first investigated the use of computers with grade seven students during 1963-68. In the intervening four decades, we have seen amazing, quantum-leap improvements in the capabilities of computers and associated technologies. Yet, during these forty years we have barely penetrated the walls of tradition in the classroom. Very, very few mathematics teachers embrace the use of such powerful tools as

the Geometer's Sketchpad, spreadsheets, Graphing Calculator, or Fathom that can transform the very nature of the mathematical experiences of students and teachers. Why not? Because little research documents or supports the experiences many of us now routinely have with our students: evidence of

a. improved understanding of concepts without loss of desirable skills,
b. development of new kinds of skills for working in computer environments,
c. new and better problem-solving abilities that build upon the power of these tools,
d. greater willingness to explore and investigate mathematical situations using the tools, resulting in a new understanding that mathematics is a human endeavor,
e. creative construction of demonstrations and solutions that can include a multi-media, multi-sensory approach,
f. increased ability and willingness to communicate about one's mathematical experiences and productions using computer tools.

With billions being spent on technology in schools, we desperately need research focused on its impacts and consequences in mathematics classrooms. With access from home and other community sites, such research needs to extend beyond the walls of the classroom or school. With wireless access likely to develop this decade, access for students and all others in rural locales will be further amplified. The time is at hand to develop a clear evidentiary base for such approaches to learning and teaching mathematics.

It may well be through the computer and the Web that the "cultural revolution in rural mathematical education" will occur in its most promising manifestations. If the ACCLAIM project can lead the way for rural Appalachia, it may well also serve as a national leader for the more fundamental, and pervasive, cultural revolution in U.S. mathematics that we need.

References

Hatfield, L. (1998). Helping mathematics teachers: Perspectives on professional growth through teacher enhancement projects. Unpublished paper presented at the "Moving On Mathematically" Conference, Ohio University, Athens OH, March 13-14, 1998.

Hatfield, L. (1999). Perspectives, issues, and strategies for research in system-wide teacher enhancement projects. Unpublished paper presented at the Research Presession of the National Council of Teachers of Mathematics, San Francisco CA, April 20, 1999.

Herzog, M. & Pittman, R. (19??). Home, family, and community: Ingredients in the rural education equation. *Phi Delta Kappan*, 77(2), 113-9.

Ladson-Billings, G. (1994). *The dreamkeepers: Successful teachers of African-American children*. San Francisco, CA: Jossey-Bass Publishing.

Ladson-Billings, G. (1998). It doesn't add up: African-American students' mathematical achievement. In C. Malloy & L. Brader-Araje(Eds.), *Challenges in the mathematics education of African-American children: Proceedings of the Benjamin Banneker Association Leadership Conference* (pp. 7-14). Reston, VA: National Council of Teachers of Mathematics.

Morse, A. (2001, April). Exploring the parent context in mathematics change in schools. Paper presented at the NCTM Research Presession, Orlando FL.

NCTM (2000). Principles and Standards for school mathematics. Reston, VA: National Council of Teachers of Mathematics.

Shumow, L. (1998). Promoting parental attunement to children's mathematical reasoning through parent education. Journal of Applied Developmental Psychology, 19(1): 109-27.

Steele, C. (1997). A threat in the air: How stereotypes shape intellectual identity and performance. *American Psychologist*, 52, 613-29.

Tate, W. (1997). Race-ethnicity, SES, gender, and language proficiency trends in mathematics achievement: An update. *Journal for Research in Mathematics Education*, 28(6), 652-79.

Ma, L. (1999). Knowing and Teaching Elementary Mathematics: Teachers' Understanding of Fundamental Mathematics in China and the United States. Mahwah NJ: Lawrence Erlbaum Associates.

Ma, X. (1999). A meta-analysis of the relationships between anxiety toward mathematics and achievement in mathematics. Journal for Research in Mathematics Education, 30(5) 520-40.

Usiskin, Z. (1988). The beliefs underlying UCSMP, UCSMP Newsletter, No. 2 (Winter).

NOTES

[1] Prepared and presented as an invited paper for the First Research Initiative Symposium of the Appalachian Collaborative Center for Learning, Assessment, and Instruction in Mathematics (ACCLAIM), sponsored by the National Science Foundation, November 3-6, 2002. Opinions expressed are those of the author and do not necessarily reflect those of the ACCLAIM project or the NSF.

[2] Comments and reactions are invited, and may be addressed to:

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[3] **A Post-Symposium Note:** Based upon Craig Howley's discussion of the paper during the Symposium, there seemed to be some confusion or misinterpretation surrounding the notion of a "culture of failure." Rural educators expressed concerns related to the negative labeling, in part due to the risks that stereotyping may contribute to the biases or prejudices held by many who negatively judge rural culture. In an effort to clarify my ideas, I offer the following discussion.

I accept and concur with cautions for negative labeling. I would personally never seek to communicate directly this notion to rural participants. My intention was not to do so. Rather, I asserted the existence of a "culture of failure" as a construct for shaping our thinking for research. From my own experiences (not from research evidence), I have developed a sense that there does exist such a culture. I submit that, if we sought to document and assess its nature and scope, we would find strong indicators that it is there, pervasively anchored in the all too negative personal experiences of rural people, and that it functions to de-value mathematical education in the schools. I believe its consequences are lowered local standards, goals and ambitions, efforts, and achievements. , At the end of this paper's "Foreground" section, I urge that initial research (perhaps as part of the "terrain" aspect) focus on the nature and scope of this "culture of failure." I still hope that this can be done within ACCLAIM, with all of the expressed cautions that were discussed at the Symposium.

[4] The ideas of a "cultural revolution in rural school mathematics" enacted by creating a three-pronged support system, represented by a three-legged stool, are drawn from my the proposal entitled, **Georgia Academy for Mathematical Excellence in Rural Schools (GAMERS)**, submitted to the Math and Science Partnership Program of NSF.

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